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Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

**UTILITY
PATENT APPLICATION
TRANSMITTAL**

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No. 325772017700 Total Pages 2

* First-Named Inventor or Application Identifier

Yujiro SUZUKI

TITLE

NEAR FIELD LIGHT GENERATING DEVICE

CERTIFICATE OF HAND DELIVERY

I hereby certify that this correspondence is being hand filed with the United States Patent and Trademark Office in Washington, D.C. on June 7, 2000.


Jinrong Li

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. Fee Transmittal Form
(Submit an original, and a duplicate for fee processing)
2. Specification [Total Pages 20]
(preferred arrangement set forth below)
 - Descriptive title of the Invention
 - Cross References to Related Applications
 - Statement Regarding Fed sponsored R & D
 - Reference to Microfiche Appendix
 - Background of the Invention
 - Brief Summary of the Invention
 - Brief Description of the Drawings (if filed)
 - Detailed Description
 - Claim(s)
 - Abstract of the Disclosure
3. Drawing(s) (35 USC 113) [Total Sheets 5]
4. Oath or Declaration [Total Pages 3]
 - a. Newly executed (original or copy)
 - b. Copy from a prior application (37 CFR 1.63(d))
(for continuation/divisional with Box 17 completed)
[Note Box 5 below]
 - i. **DELETION OF INVENTOR(S)**
Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b)
5. Incorporation By Reference (useable if Box 4b is checked)
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

ADDRESS TO: Assistant Commissioner for Patents
Box Patent Application
Washington, DC 20231

6. Microfiche Computer Program (Appendix)
7. Nucleotide and/or Amino Acid Sequence Submission
(if applicable, all necessary)
 - a. Computer Readable Copy
 - b. Paper Copy (identical to computer copy)
 - c. Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

8. Assignment Papers (cover sheet & document(s))
9. 37 CFR 3.73(b) Statement Power of Attorney
(when there is an assignee)
10. English Translation Document (if applicable)
11. Information Disclosure Statement (IDS)/PTO-1449 Copies of IDS Citations
12. Preliminary Amendment
13. Return Receipt Postcard (MPEP 503)
(Should be specifically itemized)
14. Small Entity Statement filed in prior application, Status still proper and desired
15. Certified Copy of Priority Document(s)
(if foreign priority is claimed)
16. Transmittal of Priority Document.....

17. If a CONTINUING APPLICATION, check appropriate box and supply the requisite information:

- Continuation Divisional Continuation-in-part (CIP) of prior application No:

18. CORRESPONDENCE ADDRESS

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- If a paper is untimely filed in the above-referenced application by applicant or his/her representative, the Assistant Commissioner is hereby petitioned under 37 C.F.R. § 1.136(a) for the minimum extension of time required to make said paper timely. In the event a petition for extension of time is made under the provisions of this paragraph, the Assistant Commissioner is hereby requested to charge any fee required under 37 C.F.R. § 1.17(a)-(d) to **Deposit Account No. 03-1952**. However, the Assistant Commissioner is **NOT** authorized to charge the cost of the issue fee to the Deposit Account.

The filing fee has been calculated as follows:

FOR	NUMBER FILED	NUMBER EXTRA	RATE	CALCULATIONS
TOTAL CLAIMS	17 - 20 =	0	x \$18.00	\$0.00
INDEPENDENT CLAIMS	2 - 3 =	0	x \$78.00	\$0.00
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$260.00	\$0.00
			BASIC FEE	\$690.00
			TOTAL OF ABOVE CALCULATIONS =	\$690.00
Reduction by 1/2 for filing by small entity (Note 37 C.F.R. §§ 1.9, 1.27, 1.28). If applicable, verified statement must be attached.				\$0.00
Assignment Recording Fee (if enclosed)				\$40.00
			TOTAL =	\$730.00

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Applicant(s) hereby petitions for any required relief including extensions of time and authorizes the Assistant Commissioner to charge the cost of such petitions and/or other fees or to credit any overpayment to **Deposit Account No. 03-1952** referencing docket no. 325772017700.

Dated: June 7, 2000

Respectfully submitted,

By:

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NEAR FIELD LIGHT GENERATING DEVICE

The present application claims priority to Japanese Patent Application No. 11-166844 filed June 14, 1999, the entire content
5 of which is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention pertains to a near field light generating device, and more particularly, to a device that generates near field light used for high-density recording onto an optical recording medium, or for reproduction from such a recording.

15 Description of the Related Art

In the area of optical memories in which information is optically recorded and reproduced, as computers become increasingly faster and more advanced multimedia formats are developed, an optical head that can record a larger amount of
20 information, i.e., in which the recording density is markedly improved, is being sought. A near field light recording

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technology has been proposed as a technology to realize such an optical head. In a conventional optical memory using laser light, the upper limit of recording density is determined based on the diffraction limit of the light, and recording and reproduction are possible only of marks the size of the wavelength of the light (approximately several hundred nanometers). With an optical memory using the near field light phenomenon that has been proposed in recent years, an optical head comprising a probe that has a small opening smaller than the wavelength of the light or solid immersion lens is placed as close to the recording medium (optical disk) as several tens of nanometers, and recording/reproducing light is irradiated onto the recording medium. Consequently, marks as small as several tens of nanometers, beyond the diffraction limit of the light, may be written and read as signals.

The probe referred to above is made of a medium having a high refractive index and has a small opening, such that near field light may pass through this small opening. For example, Japanese Laid-Open Patent Application No. Hei 7-192280 discloses a fiber probe. However, when fiber is used, optical axis adjustment is necessary for the fiber and prism, which are located between the laser light source and the small opening, and because this adjustment is complex, the manufacturing cost increases. Moreover, this technology has the problem that the weight of the

optical head itself increases, which translates into a longer access time.

A solid immersion lens technology is disclosed in U.S. Patent No. 5,729,393. However, where a solid immersion lens is used, 5 optical axis adjustment is also necessary for such things as the condenser lens and holder, which means that it has the same problem as the fiber probe.

On the other hand, U.S. Patent No. 5,625,617 discloses a technology in which a concave area is formed on the light exit surface of the semiconductor laser through focus ion beam (FIB) treatment so that near field light may be generated from this concave area. However, since FIB treatment uses a high-energy ion beam, there is a possibility that the light exit surface, which also comprises a cleavage plane that plays an important role as a laser resonant surface, may be damaged, resulting in laser oscillation failure.

SUMMARY OF THE INVENTION

The object of the present invention is to provide a near field 20 light generating device that has a simple construction and that does not require complex optical axis adjustment.

Another object of the present invention is to provide a near field light generating device that does not experience such problems as laser oscillation failure.

These and other objects are attained by a near field light generating device comprising: a light emitting element that emits light from its exit surface; and a thin film that is formed on the exit surface and gains a light transmitting property when 5 irradiated with light from the light emitting element.

The objects described above are also attained by a near field light generating device comprising: a light emitting element that emits light from its exit surface; and a thin film that is formed on the exit surface and gains a light transmitting property when heated.

For the thin film mentioned above, inorganic materials or organic materials having a low melting point are used. If an inorganic material is used, it is preferred that the melting point be 350°C or less, and more preferably, that a metal material having a melting point of 150°C or lower be used. It is also preferred that a heat diffusion preventing film exist between the light exit surface and the thin film.

In the near field light generating device pertaining to the present invention, because the area of the thin film irradiated 20 with the light emitted from the light exit surface is heated, it becomes amorphous and transforms into a small light transmitting area. This small light transmitting area functions in the same way as the small opening of the conventional probe, and allows the emitted light to escape as near field light. The 25 irradiated area of the thin film returns to a crystalline state

from an amorphous state when the light emission is stopped, thereby ensuring reproducibility.

In other words, the near field light generating device pertaining to the present invention has an extremely simple construction, comprising only a light emitting element and a thin film formed on the light exit surface of the light emitting element, making it compact in size and lightweight. Therefore, the near field light generating device pertaining to the present invention is quite suitable for a near field light optical head.

In addition, because a small light transmitting area that generates near field light is formed in the thin film by means of the light emitted from the light emitting element, the complex process of aligning the optical axes of multiple components is not necessary. The near field light generating device pertaining to the present invention may also be mass-produced using ordinary semiconductor manufacturing technology. Therefore, it may be manufactured at a low cost.

In particular, it is preferred that a semiconductor laser be used as the light source. A semiconductor laser is small in size and lightweight, and is best suited for the near field light generating device in today's market. Further, the present invention does not use a high-energy focus ion beam, and therefore the possibility of damage to the laser's cleavage plane and resulting oscillation failure is eliminated.

The invention itself, together with further objects and attendant advantages, will best be understood by reference to the following detailed description taken in conjunction with the accompanying drawings.

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BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows the basic construction of an information recording/reproducing device equipped with the optical head comprising a first embodiment of the present invention.

Fig. 2 is a cross-sectional view of the optical head.

Fig. 3 is a bottom view of the optical head, in which the protective film, which comprises the lowest layer, is omitted.

Fig. 4 is a drawing to explain the manner in which the laser light from the semiconductor laser used in the optical head is diffused.

Fig. 5 is a graph showing the distribution of the radiant intensity of the laser light from the semiconductor laser.

Fig. 6A through Fig. 6E are drawings to explain the

manufacturing process for the optical head.

20 Fig. 7 is a cross-sectional view of the Knudsen cell used in the manufacturing of the optical head comprising a second embodiment of the present invention.

Fig. 8 is a drawing showing the basic construction of the vacuum film forming device used in the manufacturing of the

optical head comprising a second embodiment of the present invention.

Fig. 9 is a bottom view of the optical head comprising a third embodiment of the present invention, in which the protective film, 5 which comprises the lowest layer, is omitted.

Fig. 10 is a drawing to explain the optical head comprising a third embodiment of the present invention in use.

In the following description, like parts are designated by like reference numbers throughout the several drawings.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The embodiments of the near field light generating device pertaining to the present invention are explained below with reference to the accompanying drawings.

(First embodiment)

The near field light generating device comprising a first embodiment of the present invention is indicated as the optical head 5 in Fig. 1, which shows an information recording/reproducing device. In Fig. 1, the recording disk 1 has a recording layer 2 on its surface, and is fixed to a spindle 3 such that it may be driven to rotate at a fixed rate. The optical head 5 is mounted to the end of an actuator 6, and is controlled

such that it is kept apart from the surface of the recording disk 1 by a small distance of several tens of nanometers.

The optical head 5 comprises a semiconductor laser 11, a heat diffusion preventing film 13 and a low melting point thin film 14 formed in that order on the cleavage plane 12, which is the light exit surface for the semiconductor laser 11, and a protective layer 15 formed on top of the low melting point thin film 14. A pair of light detectors 16 are formed around the low melting point thin film 14, as shown in Fig. 2.

Power is supplied to the semiconductor laser 11 from the lines 18 connected to a power supply circuit not shown in the drawing, and the semiconductor laser 11 emits wavelength λ laser light from the cleavage plane 12 such that the light is diffused at the angle of expansion shown in Fig. 4. The energy of the laser light has the Gaussian distribution shown in Fig. 5, in which the energy level rises towards the center. Fig. 5 shows the radiant intensity distribution of a TE_{00} mode beam. The radius (w) of the beam is determined by the point at which the intensity is $1/e^2$ of the maximum intensity (≈ 0.135).

The heat diffusion preventing film 13 comprises SiO_2 , for example. The low melting point thin film 14 comprises a material that changes its state from crystalline to amorphous and gains a light transmitting property when heated, such as indium (In) having a melting point of $156.4^\circ C$, for example. The protective film 15 comprises diamond-like carbon, for example. The light

detector 16 comprises a photo diode. Its material and construction will be explained below together with its manufacturing method.

The recording process using the optical head 5 having the
5 construction described above will now be explained. The laser light emitted from the cleavage plane 12 of the semiconductor laser 11 passes through the heat diffusion preventing film 13, and strikes the low melting point thin film 14, heating the center of the thin film 14 based on the energy distribution shown in Fig. 5. The state of the indium (In), which comprises the thin film 14, begins to change to amorphous when the temperature reaches approximately 130°C. An amorphous light transmitting area 14a is formed, and near field light passes through this light transmitting area 14a.

15 The size of the light transmitting area 14a formed when light is emitted may be adjusted by controlling the energy supplied to the semiconductor laser 11. It is preferred that the diameter of this opening be adjusted to 100 nanometers. By setting the distance between the optical head 5 and the recording disk 1 to
20 . be 20 to 100 nanometers, the near field light passing through the light transmitting area 14a irradiates the recording layer 2, and forms a recording pit 2a. Where the opening diameter of the light transmitting area 14a is 100 nanometers, the diameter of the recording pit 2a also becomes approximately 100 nanometers,

and the surface recording density becomes quite high at approximately 50 Gbit per square inch.

When the emission of laser light from the semiconductor laser 11 is stopped, the thin film 14 cools down naturally, and the 5 light transmitting area 14a returns to a crystalline state from an amorphous state.

The reproduction process will now be explained. Similarly to the recording process, near field light passes through the light transmitting area 14a and irradiates the recording layer 2. This near field light is converted into ordinary transmitted light and is reflected. The reflected light is detected by the light detectors 16 and a reproduction signal corresponding to the recording pit 2a is obtained.

During the reproduction, because the light detectors 16 are located very close to the reflection surface (recording layer 2), there is little loss of light, and therefore a good reproduction signal may be obtained. Further, because a pair of light detectors 16 are used, a tracking signal may be detected as well by detecting the difference in detected light amount 20 between the right and left light detectors.

The manufacturing method for the optical head 5 comprising the first embodiment will now be explained with reference to Fig. 6A through Fig. 6E.

First, SiO_2 is formed into a film having a thickness of 10-20 25 nanometers by means of sputtering as the heat diffusion

preventing film 13 on the cleavage plane 12 of the semiconductor laser 11 as shown in Fig. 6A. Indium (In) is then formed into a film having a thickness of 20-50 nanometers by means of sputtering or vacuum deposition as the low melting point thin film 14 as shown in Fig. 6B. The thin film 14 is then processed by means of photo-etching as shown in Fig. 6C. This processing is performed such that the thin film 14 will have a diameter of approximately 300 nanometers with the optical axis at the center.

The light detectors (photodiodes) 16 are then formed around the thin film 14. The light detector 16 comprises, as shown in Fig. 6D, an electrode 16a, a P layer 16b, an I layer 16c, an N layer 16d and an electrode 16e. The electrode 16a is formed by patterning aluminum (Al) on the heat diffusion preventing film 13 such that its thickness will be 20 nanometers. The P layer 16b and N layer 16d are made by doping silicon (Si) with phosphate (P) and boric acid (B), respectively, such that a regular pn connection will be formed. The I layer 16c is formed using amorphous silicon (Si). The other electrode 16e is made of aluminum (Al), and is formed using a sputtering method that will give it a thickness of 20 nanometers thickness.

The low melting point thin film 14 and the light detector 16 have the same thickness. Diamond-like carbon is then formed into film having a thickness of 10-20 nanometers by means of ion plating, and becomes the protective film 15 on top of the low

melting point thin film 14 and the light detectors 16 as shown in Fig. 6E.

While indium (In), which is a metal material with a low melting point, was used as the material of the thin film 14 in the first embodiment, it is also acceptable to use tin (Sn), which has a melting point of 231.84°C, or lead (Pb), which has a melting point of 327.4°C. Antimony (Sb), which has a melting point of 630.5°C, may be used depending on the film forming parameters.

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(Second embodiment)

The optical head comprising a second embodiment has basically the same construction as the first embodiment shown in Fig. 2, but uses stearic acid, which has a melting point of 70.1°C, for the thin film 14. The manufacturing method for this optical head will be explained with reference to Figs. 6, 7 and 8.

SiO₂ is first formed into film having a thickness of 10-20 nanometers, which is used as the heat diffusion preventing film 13, by means of sputtering on the cleavage plane 12 of the semiconductor laser 11. Stearic acid is then formed into film having a thickness of 50-100 nanometers, which is used as the low melting point thin film 14, by means of vacuum film forming using Knudsen cells, evaporation sources exclusively used for organic materials. The thin film 14 is then processed by means 25 of photo-etching. This processing is performed such that the thin

film 14 will have a diameter of approximately 300 nanometers with the optical axis at the center.

As shown in Fig. 7, stearic acid is placed in the Knudsen cell 20 comprising a crucible 21 equipped with a heater 22 and a temperature measuring thermocouple 23, and is formed into thin film 14 using a vacuum film forming device. The basic construction of the vacuum film forming device is as shown in Fig. 8. The sample (the semiconductor laser 11) is mounted to the rotary holder 27 inside the vacuum chamber 25 equipped with an evacuation system 26, and the stearic acid is deposited on the sample from a pair of Knudsen cells 20 while the shutters 28 are controlled such that they are opened and closed.

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The light detectors (photodiodes) 16 are then formed around the thin film 14. Each light detector 16 comprises, as shown in Fig. 6D, an electrode 16a, a P layer 16b, an I layer 16c, an N layer 16d and an electrode 16e. The electrode 16a is made by patterning aluminum (Al) on the heat diffusion preventing film 13 such that its thickness is 20 nanometers. The P layer 16b and N layer 16d are made by doping silicon (Si) with phosphate (P) and boric acid (B), respectively, such that a normal pn connection will be formed. The I layer 16c is formed using amorphous silicon (Si). The other electrode 16e is made of aluminum (Al), and is formed using a sputtering method that will give it a thickness of 20 nanometers.

The low melting point thin film 14 and the light detector 16 have the same thickness. Diamond-like carbon is then formed into film having a thickness of 10-20 nanometers by means of ion plating, which is used as the protective film 15 and placed on top of the low melting point thin film 14 and the light detectors 16.

While stearic acid was used as the organic material with a low melting point in the second embodiment, it is also acceptable to use lead stearate having a melting point of 125°C.

The recording and reproduction processes in the second embodiment are the same as the first embodiment.

(Third embodiment)

In the third embodiment, as shown in Fig. 9, eight light transmitting areas 14a are formed in a straight line on one optical head 5'. Each near field light emitting element has the same cross-sectional construction as that shown in Fig. 2, and a surface emission semiconductor laser having a quantum well construction is used. The laser light emitted from a surface emission laser of this type also has the characteristics shown in Figs. 4 and 5. The low melting point thin film 14 is heated using the beam center of the laser light, where the energy intensity is strong, so that the thin film 14 will turn amorphous and a light transmitting area 14a will be formed.

The metal materials or organic materials referred to above in connection with the first and second embodiments may be used for the low melting point thin film 14. For example, as the thin film 14, tin (Sn) having a melting point of 231.84°C may be formed into film having a thickness of 20-50 nanometers by means of vacuum film forming such as sputtering or vacuum deposition. The remainder of the construction and the manufacturing method is the same as in the first and second embodiments. That near field light passes through each light transmitting area 14a to perform recording and reproduction is identical to that explained with reference to the first embodiment.

In the third embodiment, as shown in Fig. 10, the optical head 5' is mounted such that the alignment line C of the light transmitting areas 14a is angled by an angle θ relative to the normal line B of the rotational locuses A of the recording pits, and eight pieces of information are recorded/reproduced at one time. Therefore, the speed of recording/reproduction is eight times as fast as that of the optical head 5 of the first or second embodiment.

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(Other embodiments)

The near field light generating device pertaining to the present invention is not limited to the embodiments explained above, but may be varied within the scope of essence of the invention.

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In particular, a laser other than a semiconductor laser or light emitting diodes may be used for the light source. In addition, various materials other than those shown with reference to the embodiments may be used for the low melting point thin film or
5 other components.

Although the present invention has been fully described by way of examples with reference to the accompanying drawings, it is to be noted that various changes and modifications will be apparent to those skilled in the art. Therefore, unless such changes and modification depart from the scope of the present invention, they should be construed as being included therein.

DRAFTED BY DRAFTING ROOM

WHAT IS CLAIMED IS:

1. A near field light generating device, comprising:

a light emitting element that emits light from its exit surface; and

5 a thin film that is formed on the exit surface and gains a light transmitting property when irradiated with light from said light emitting element.

2. A near field light generating device according to Claim 1, wherein said thin film changes its state from crystalline to amorphous when irradiated with light from said light emitting element.

3. A near field light generating device according to Claim 1, wherein said thin film returns to a crystalline state from an amorphous state when the light emission is stopped

15 4. A near field light generating device according to Claim 1, wherein said thin film essentially consists of inorganic material having a melting point of 350°C or lower.

5. A near field light generating device according to Claim 1, wherein said thin film essentially consists of inorganic 20 material having a melting point of 150°C or lower.

6. A near field light generating device according to Claim 1, wherein said thin film essentially consists of organic material having a low melting point.

7. A near field light generating device according to Claim 1, further comprising a heat diffusion preventing film between the light exit surface and the thin film

5 8. A near field light generating device according to Claim 1, wherein said light emitting element includes semiconductor laser device.

9. A near field light generating device, comprising:

a light emitting element that emits light from its exit surface; and

10 a thin film that is formed on the exit surface and gains a light transmitting property when heated.

11 10. A near field light generating device according to Claim 9, wherein said thin film changes its state from crystalline to amorphous when heated.

12 11. A near field light generating device according to Claim 9, wherein said thin film returns to a crystalline state from an amorphous state when the heating is stopped

20 12. A near field light generating device according to Claim 9, wherein said thin film essentially consists of inorganic material having a melting point of 350°C or lower.

13 13. A near field light generating device according to Claim 9, wherein said thin film essentially consists of inorganic material having a melting point of 150°C or lower.

14. A near field light generating device according to Claim
9, wherein said thin film essentially consists of organic
material having a low melting point.

15. A near field light generating device according to Claim
5 9, further comprising a heat diffusion preventing film between
the light exit surface and the thin film

16. A near field light generating device according to Claim
9, wherein said light emitting element includes semiconductor
laser device.

17. A near field light generating device according to Claim
9, wherein said thin film is heated by the light emitted from
said light emitting element.

DRAFTSHEET-060200

ABSTRACT OF THE DISCLOSURE

Heat diffusion preventing film is formed on the cleavage plane of a semiconductor laser, and thin film comprising a low melting point material, such as indium, is formed on top on the heat diffusion preventing film. When irradiated by the laser light emitted from the semiconductor laser and heated, the irradiated area of the thin film changes in state from crystalline to amorphous and forms a small light transmitting area. Near field light passes through this light transmitting area. The near field light generating device of the present invention uses a simple construction as described above, and complex adjustment is not required. In addition, problems such as laser oscillation failure do not occur.

DRAFT RELEASED BY GOVERNMENT CONTRACT

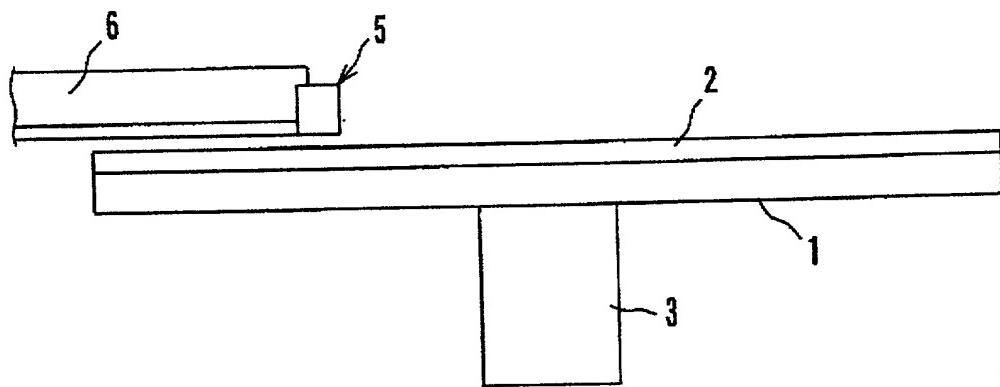


FIG. 1

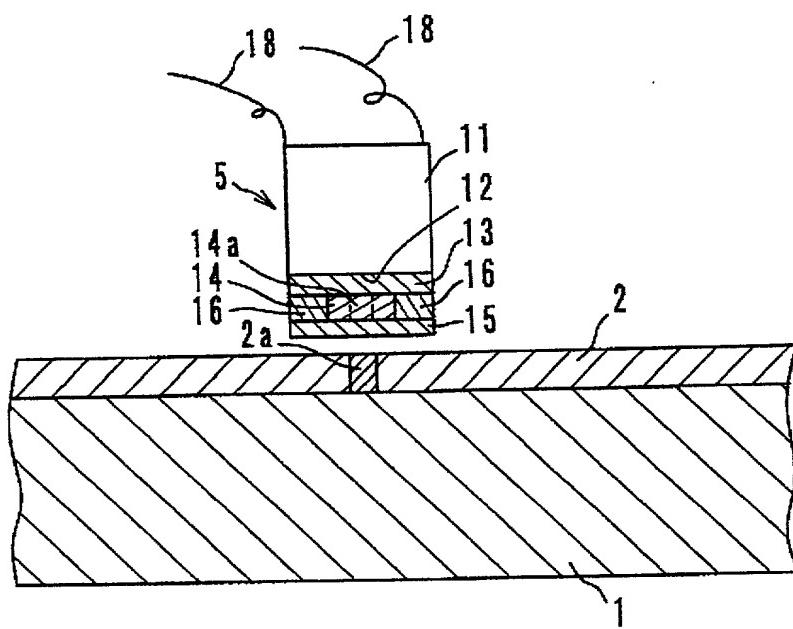


FIG. 2

0958696.060200

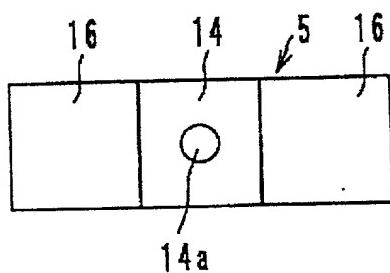


FIG. 3

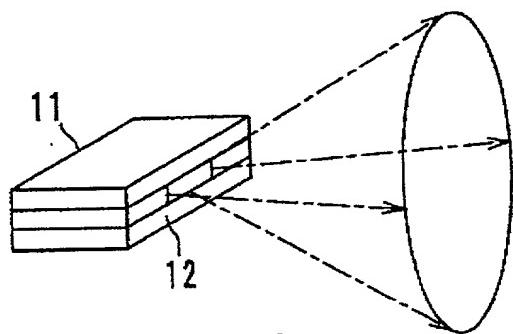


FIG. 4

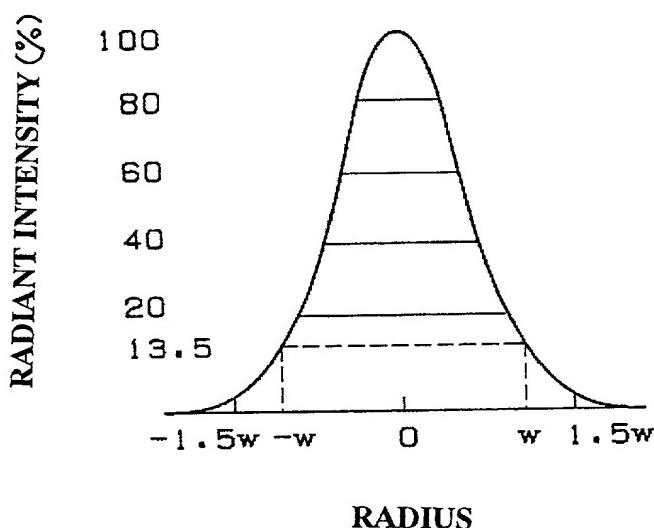


FIG. 5

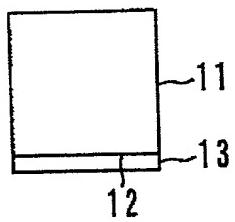


FIG. 6A

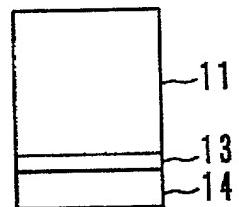


FIG. 6B

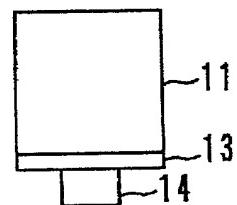


FIG. 6C

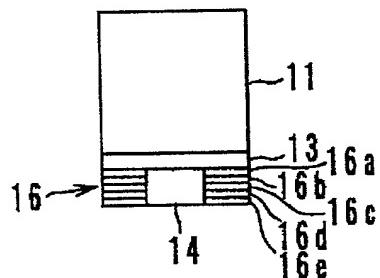


FIG. 6D

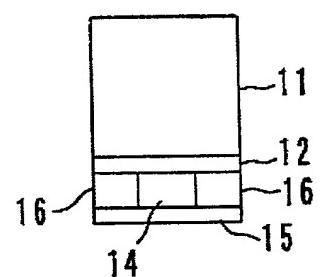
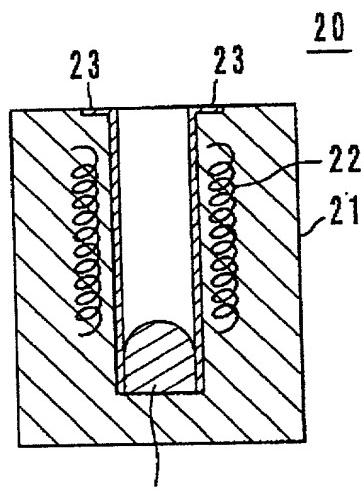


FIG. 6E



EVAPORATION SOURCE
(STEARIC ACID)

FIG. 7

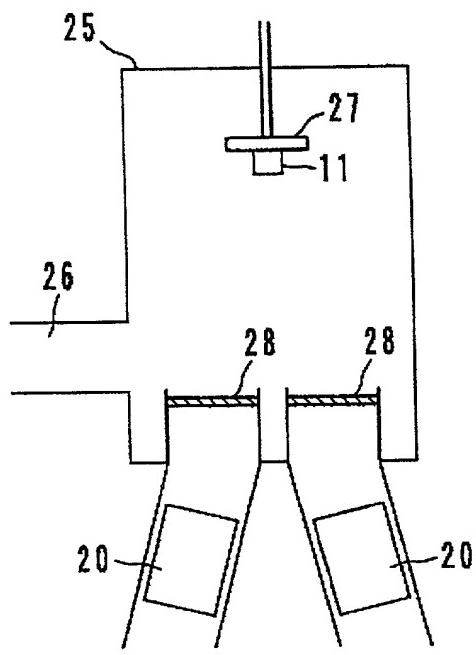


FIG. 8

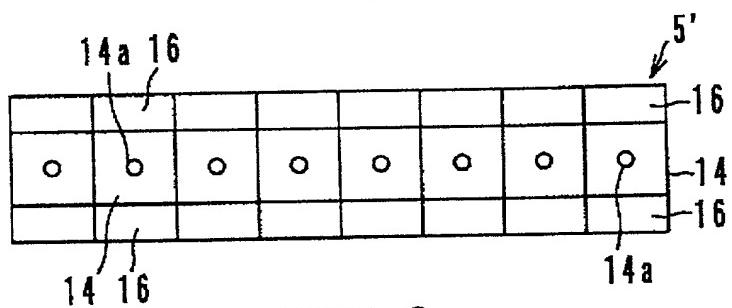


FIG. 9

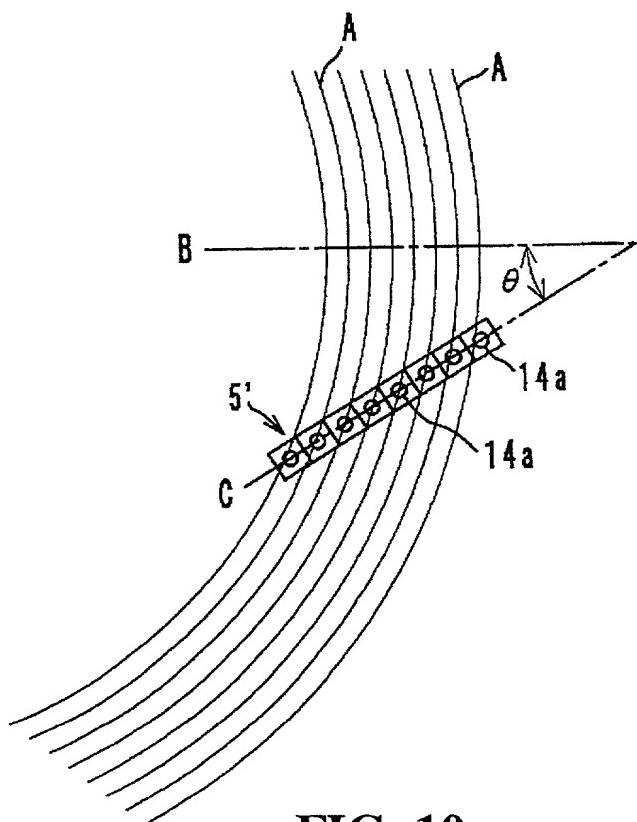


FIG. 10

PATENT
Docket No.

Client Ref.

**COMBINED DECLARATION AND POWER OF ATTORNEY
FOR UTILITY/DESIGN PATENT APPLICATION**

AS A BELOW-NAMED INVENTOR, I HEREBY DECLARE THAT:

My residence, citizenship, and post office address are as stated below next to my name.

I believe I am the original, first and sole (or joint, if more than one name appears below) inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled:

NEAR FIELD LIGHT GENERATING DEVICE

the specification of which:

- is attached hereto.
 was filed on _____ as application serial No. _____ and was amended
on _____ (if applicable).

I HAVE REVIEWED AND UNDERSTAND THE CONTENTS OF THE ABOVE-
IDENTIFIED SPECIFICATION, INCLUDING THE CLAIMS, AS AMENDED BY ANY
AMENDMENT REFERRED TO ABOVE.

I acknowledge and understand that I have a duty to disclose information which is material to the patentability of the claims of this application in accordance with Title 37, Code of Federal Regulations, §§ 1.56(a) and (b).

I hereby claim foreign priority benefits under Title 35, United States Code § 119(a)-(d) of the foreign application(s) for patent indicated below and have also identified below the foreign applications for patent or inventor's certificate on this invention having a filing date before that of the application for patent or inventor's certificate on this invention having a filing date before that of the application on which priority is claimed:

Country/International	Application No.	Date of Filing (day/month/year)	Priority Claimed?
Japan	11-166844	14/June/1999	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No.
			<input type="checkbox"/> Yes <input type="checkbox"/> No.
			<input type="checkbox"/> Yes <input type="checkbox"/> No.
			<input type="checkbox"/> Yes <input type="checkbox"/> No.
			<input type="checkbox"/> Yes <input type="checkbox"/> No.

I hereby claim benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below:

Application Serial No.	Filing Date

I hereby claim benefit under Title 35, United States Code, § 120 of any United States application(s) listed below, and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §§ 1.56(a) and (b) set forth above which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

Application Serial No.	Filing Date	Status
		<input type="checkbox"/> Patented <input type="checkbox"/> Pending <input type="checkbox"/> Abandoned
		<input type="checkbox"/> Patented <input type="checkbox"/> Pending <input type="checkbox"/> Abandoned
		<input type="checkbox"/> Patented <input type="checkbox"/> Pending <input type="checkbox"/> Abandoned

I hereby appoint the following attorneys and agents to prosecute that application and to transact all business in the Patent and Trademark Office connected therewith and to file, to prosecute and to transact all business in connection with all patent applications directed to the invention:

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under § 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

May 30, 2000

Date

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